July 5, 1932. F. G. SHOEMAKER ET AL 1,866,492

ELECTRICAL CIRCUIT INTERRUPTER

Filed June 16, 1926

FIG. 1.

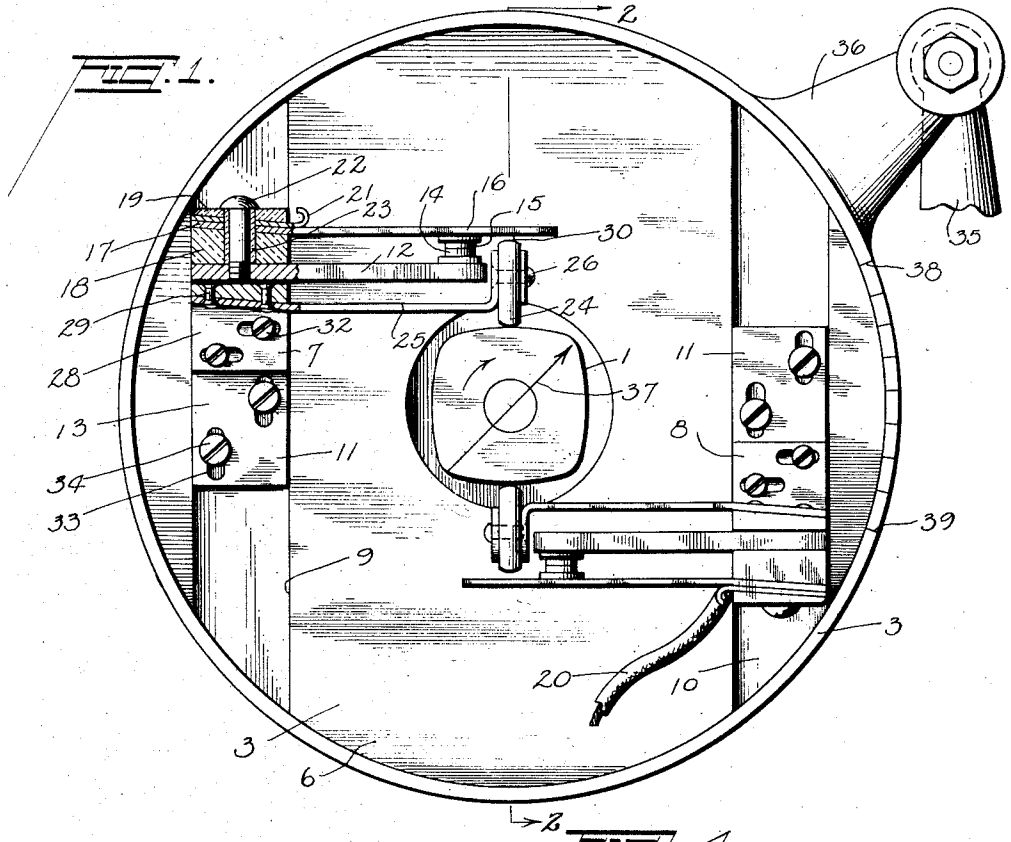


FIG. 2.

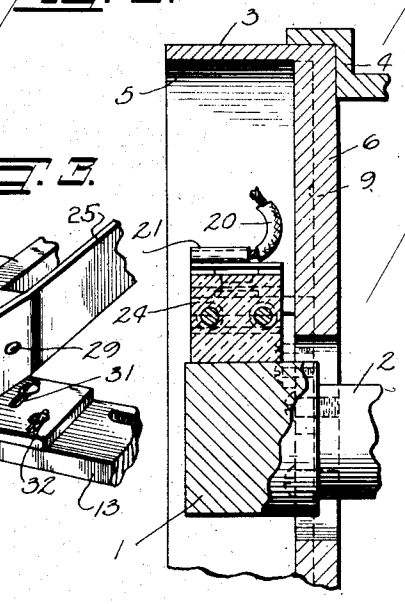


FIG. 4.

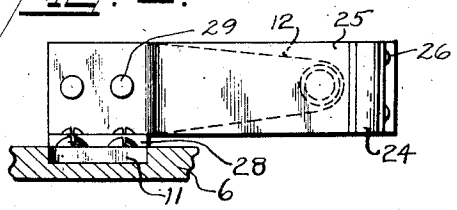


FIG. 3.

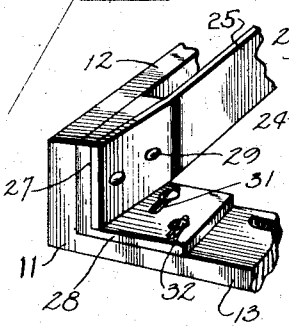
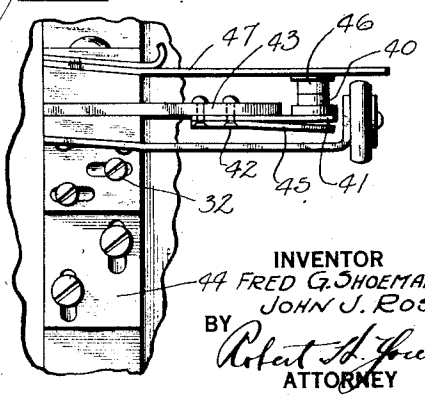


FIG. 5.



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UNITED STATES PATENT OFFICE

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ELECTRICAL CIRCUIT INTERRUPTER

Application filed June 16, 1926. Serial No. 116,360.

This invention relates to electrical circuit interrupters as used for example in breaking the circuit on the primary side in high tension ignition sets.

The primary object of the invention is the provision of an electrical circuit interrupter in which the contacts are mounted in permanent alignment with one another, both being permanently mounted in position on a support, one of the contacts being mounted on a cantilever leaf spring attached at its end to the support. The support is bodily movable in relation to the axis of a rotating cam member which effects make and break action of the contacts. This adjustment permits a change in the period or amount of opening or separation of the contacts. The contacts are opened or separated by means of a lifter or rubbing block which is forced to rub against the cam by means of a leaf spring on the end of which the rubbing block is permanently mounted. This leaf spring is attached at its anchored end to the support in such a manner that it may be adjusted in relation to the support and fixed in any position of adjustment in a rigid manner.

A further object of the invention is the provision of means for rotating the mounting block upon which the contact support is mounted to vary the timing or the moment of ignition with relation to the engine crankshaft, in conjunction with the manual adjustment or setting of the support on the mounting block, to vary the amount of opening or separation of the contacts.

For dual ignition two separate contact assemblies are provided on the same mounting block so as to engage a single cam. In order to properly time the moment the contacts separate in the two separate assemblies so that they are properly interrelated, the two lifter or rubbing block springs are independently adjustable so that the two rubbing blocks may be aligned through the center of the cam to operate simultaneously or may be moved to any desired distance away from such a central line in order to cause the separation of the two sets of contacts at the desired instants in succession.

A further object of the invention is the provision of a reference mark, surface or line upon the cam, which cooperates with reference marks upon the housing or mounting block on which the contact supports are mounted, so that the proper timing of the contacts may be effected and the contacts may be so adjusted and set that the contacts may remain open through the desired angle of rotation of the cam and so that the contacts may separate at the desired instant in proper timing relation to the cam.

Other objects are the provision of an interrupter which may be easily and cheaply constructed and assembled, and which may be operated long periods of time without attention. Use is made of perfectly flat springs whose tension is imparted to them by the angle of the faces of the adjacent parts at the ends where the springs are in place. The various parts are assembled together in position and are then easily and quickly mounted in place as a separate assembly.

Further objects and advantages of the invention will be more fully set forth in the claims and in the following description in which the preferred form of the invention is referred to for purposes of illustration. Referring mort particularly to the drawings,

Fig. 1 is a plan view of an electrical circuit interrupter showing two contact assemblies operated by a central cam,

Fig. 2 is a central section on the line 2—2 of Fig. 1,

Fig. 3 is a perspective view showing the adjustable manner in which the rubbing block spring is mounted on the angle support block,

Fig. 4 is a side elevation of the contact assembly looking at the lifting or rubbing block spring, and

Fig. 5 is a plan view of a modified form of contact assembly in which both of the contacts are mounted on spring arms.

Referring more particularly to the drawing by reference numerals, a four-lobed cam 1 is mounted on a suitable shaft 2 and the drum-shaped mounting block 3 is rotatably mounted in a suitable housing or support 4. This mounting block 3 has a housing or rim 5 surrounding the cam and the plate 6 forms a back of the housing and serves as a mount

for the contact assemblies designated generally 7 and 8. The plate 6 is provided with two grooves 9 and 10 within which neatly fit the two angle support members 11 of the assemblies 7 and 8.

Each contact assembly has its various parts attached fixably together and the cantilever leaf springs employed permit the parts of the assembly to be joined together in a pivotless manner. The angle contact support member 11 has an arm 12 which extends laterally away from the bottom face 13 of the member. Permanently attached at the end of the rigid arm 12 is a contact 14 and mounted in permanent alignment therewith so that their relationship cannot be changed is a second contact 15. The contact 15 is mounted permanently at the center of percussion of a cantilever leaf spring 16 which is fixed at one end of the member 11. Between arm 12 and the fixed end 17 of the spring 16 is an insulating block 18 and a second insulating strip 19 is placed on the other side of the spring. An electrical conductor 20 has its end connected to an electrical lug 21 made of conducting material and placed in contact with the end of the spring. The housing block 6 is of course grounded. These various parts of the contact assembly are all permanently and rigidly attached together by means of rivets or screws 22 extending through insulating bushings 23.

One face of the insulating blocks 19 and 18 is angularly positioned in relation to the other face so that a flat leaf spring 16 may be used. The tension of the spring is imparted by reason of the angular position of the face of the insulating blocks, it being understood that the spring 16 is preferably flat before assuming its assembled position.

The contacts 14 and 15 are separated by means of a rubbing block 24 which is engageable with the outer portion of the spring 16 so as to move the movable contact 15 away from the fixed contact 14 as the cam 1 revolves. The rubbing block 24 is fixed to the end of a cantilever leaf spring 25 by means of suitable rivets 26. The end of the steel spring 25 is riveted permanently to the face 27 of an angle block 28 by means of the rivets 29. The face of the angle block which contacts with the spring 25 is at such an angle as shown, that the rubbing block 24 will be forced to remain in engagement and rub on cam 1 as the cam rotates. This permits a flat spring 25 to be used and have the tension imparted to it by reason of the angle of the face of the angle block.

The rubbing block 24 is made of suitable insulating material such as fiber and of such size as to provide a space 30 between it and the spring 16, when the rubbing block is in engagement with the lowest portion of the cam.

The angle piece 28 is adjustably mounted on the member 11, being provided with slot 31 through which screws 32 extend, the screws being threaded into the bottom leg 13 of the block 11. The slots 31 extend laterally so as to permit the rubbing block to be moved to the right or left from its position shown in Fig. 1. The entire assembly may be moved rectilinearly so as to adjust the amount of separation of the contacts but without disturbing their relation one to the other. This is accomplished by the provision of the elongated slots 33 in the face 13 of the contact support. Adjusting and locking screws 34 extend through these slots and attach to the plate 6.

The two contact assemblies 7 and 8 are identical in all respects and the preceding description may apply to either of these assemblies. The two assemblies are preferably mounted on opposite sides of the cam as shown and both assemblies are rotatable in unison and to equal degrees when the mounting block is rotated about the axis of cam 1. This is accomplished by means of a manually operated rod 35 which is attached to the end of the projecting lug 36 of the housing 3 and by means of which the ignition is advanced or retarded in relation to the camshaft.

In order to properly time the moment when the two contacts of one assembly separate, a lamp with a battery in series may be temporarily connected to the lug 21 and grounded to the mounting block 6 so that when the circuit is broken by the separation of the contacts 14 and 15 the lamp will go out at the instant that the contacts are separated and will again be lighted the instant the contacts are again closed. In order to determine when the contact assembly is in its proper relation to the cam, an index line or groove 37 or an equivalent surface flat is provided on the end side of the cam 1. Reference markings are provided on the rim 3 of the housing or mounting block, a suitable mark being provided at 38 which will indicate that the contact assembly is properly located if the contacts open when the line 37 is aligned with the reference mark 38. A reference mark 39 is also provided to show when the contacts should close with the contact assembly properly positioned.

In Fig. 5 is shown a modification of the invention in which the contact 40 is mounted on a cantilever leaf spring 41 which is anchored at its inner end by the rivets 42 to the rigid arm 43 integral with the plate 44, the arm 43 and plate 44 corresponding to the parts 12 and 13 of the support 11. The contact spring 41 is prevented from having any considerable movement by the rigid arm or plate 45 which forms a limiting stop for the downward movement of the spring 41 and permits this spring only a slight limited movement. The upward movement of the spring is very small from the position shown

in Fig. 5 due to the small distance to the end of the rigid arm 43. The slight limited movement of the contact 40 in a substantially vertical direction produces a slight rubbing action of the contact 40 with the contact 46 which is mounted on the leaf spring 47. When the contact 46 strikes the contact 40 it moves it downward slightly and thus causes a slight rubbing between the two contacts which may be made sufficient to keep the contact surfaces clean and smooth at all times and prevent or reduce the pitting effect of the electric arc on the contacts. The contacts may have their working surfaces horizontal or arranged in an inclined plane.

The operation of the electrical circuit interrupter is as follows: The cam 1 rotates in a clock-wise direction and as it does so the rubbing blocks move up and down and follow the cam, against which they are forced to bear by reason of the tension imparted by the springs on which they are mounted. This rubbing block is engageable with the spring 16 at a point close to the contact 15 after the cam has rotated a slight amount from the position shown in Fig. 1. When the rubbing block 24 is moved upwardly a distance equal to the space 30, the rubbing block will strike the spring and cause the separation of the contacts. The spring 16 with the contact 15 thereon may be made very light since the rubbing block is not attached to the spring 16, and the impact of the rubbing block against the spring 16 will be very small thus causing a minimum of wear on the rubbing and contacting surfaces of the interrupter. The small mass of the moving contact spring permits a comparatively light contact spring pressure. The impact load on the contacts at closing is due to this small mass alone. The natural period of vibration of the moving contact spring 16 can be easily kept above the normal operating speeds required for ignition of internal combustion engines without introducing high spring tension with resulting high contact pressure. Furthermore, the mounting of the contact 15 at the center of percussion of spring 16 prevents any tendency for the contacts to rock when they close. The lifter or rubbing block is already in motion when the contact spring is struck and a rapid separation of the contacts is obtained without accelerating all of the moving parts at the same instant and without introducing high impact loads on the cam, rubbing block, or contact spring.

The tensions of the springs 16 and 25 are such that the rubbing block and contact spring follow the movement imparted by the cam even at very high speeds. The space 30 permits a complete closure of the contacts and furthermore permits a quick opening of the contacts. The two contacts 14 and 15 being mounted in permanent alignment with one another in a pivotless manner will insure the full efficiency of the contacts by utilizing the complete contact area and thus preventing misalignment or lipping of the contacts. It has been found that when used with magneto ignition where the current is alternating the contacts remain perfectly smooth and flat and in permanent alignment at all times and their life is almost indefinite. When used with direct current a slight pitting may occur if the contacts are prevented from rubbing one on the other by mounting one of the contacts as shown in Fig. 1 on a fixed rigid arm. This pitting, however, does not disturb the action of the contacts since the faces of the contacts, even when pitted, fit neatly into one another. This pitting effect may be removed or reduced by the construction shown in Fig. 5 by mounting the contacts so that they may rub slightly one on the other.

When used with dual ignition it is often preferred to fire the spark plugs on the intake side of the engine several degrees ahead of those on the exhaust side. In order to permit the exact timing of the breaking of the contacts of the two contact assemblies, the various adjustments described are provided. The breaker assembly is adjusted vertically (see Fig. 1) by means of the fastening screws 34 so as to give the correct angular movement of the cam while the contacts remain open or separated. The contact should open when the index line 37 points to the reference 38 and should close when the line 37 points to the reference 39. This will ordinarily permit the contacts to remain open for about 40° of travel of a four-lobed cam. After the two contact assemblies have been adjusted vertically so that the contacts remain open the desired interval in relation to the cam travel, the rubbing block 24 is adjusted to right or left by means of the screws 32 so that the contacts may be opened slightly sooner or slightly later in relation to the cam position. This will not materially disturb the angular interval during which the contacts remain open but will change the time at which this interval occurs in relation to the cam. The two contact assemblies may therefore be made to operate so that one pair of contacts opens several degrees ahead of the other pair. The spark plugs on the intake side may therefore be made to operate the proper angular interval ahead of the plugs on the exhaust side of the engine. It has been found desirable to adjust the breaker assemblies so that the contacts open .006″ to .01″. The rubbing block or lifter preferably moves between .02″ and .03″. The rubbing block spring is preferably adjustably mounted on the contact assembly when two breaker assemblies are used in conjunction, as shown, so that they may be properly timed together, although obviously they need not necessarily be adjust-

ably mounted on the breaker assembly unless such adjustment is desirable.

We are aware that various changes and modifications may be made without departing from the spirit or scope of our invention and we do not intend to be limited to the construction herein chosen for purposes of illustration but define our invention in the following claims.

1. An electrical circuit interrupter comprising a pair of make and break contacts, a contact support on which said contacts are mounted in permanently fixed facial relation when contacting with each other, means for effecting make and break action of said contacts, and means for adjusting said support to bodily move said contacts rectilinearly equally and simultaneously without disturbing their facial relation one to the other to obtain a predetermined extent of separation or dwell of said contacts at a predetermined instant in the proper timing relation of said cam.

2. An electrical circuit interrupter comprising a pair of make and break contacts, a contact support on which said contacts are mounted in permanently fixed facial relation when contacting with each other, a leaf spring fastened at one end rigidly to said support and having one of said contacts mounted directly thereon at substantially the center of percussion of said spring, means independent of and engageable with said spring adjacent to said contact for effecting make and break action of said contacts.

3. An electrical circuit interrupter comprising a pair of make and break contacts, a contact support on which one of said contacts is mounted permanently in position, a spring fixed to said support and bearing the other contact at its free end in permanently fixed facial relation when contacting with the other contact and means for adjusting said contact supports rectilinearly, equally and simultaneously without disturbing their facial relation one to another to obtain a predetermined extent of separation or dwell of said contacts at a predetermined instant in the proper timing relation of said cam.

4. An electrical circuit interrupter comprising a pair of make and break contacts, a contact support on which one of said contacts is mounted, a spring fixed to said support and bearing the other contact at its free end in permanently fixed facial relation when contacting with the first contact, rotatable means for moving said spring and effecting make and break action of said contacts, means for adjusting said support in relation to the axis of the rotatable means, and means for bodily moving said support rectilinearly to simultaneously move said contacts without disturbing their relation one to the other.

5. An electrical circuit interrupter comprising a pair of make and break contacts, a contact support on which one of said contacts is mounted, a spring fixed to said support and bearing the other contact at its free end in permanently fixed facial relation when contacting with the first contact, rotatable means for effecting make and break action of said contacts, means for adjusting said support in relation to the axis of the rotatable means, a mounting block, means for moving said support on said block to simultaneously move said contacts without disturbing their relation one to the other, and means for rotating said mounting block to vary the time of making and breaking of the contacts.

6. An electrical timer of the class described, comprising a pair of make and break contacts, a contact support on which one contact is fixed, a leaf spring fixed at one end to said support and bearing the other contact thereon in alignment with said first contact, a rotatable cam member, a rubbing block bearing on said cam member and engaging said spring to lift the spring and relatively move the contacts, a leaf spring fixed to said support and bearing said rubbing block permanently thereon at its end, and operating to maintain said rubbing block in engagement with said cam, and a mounting block to which said support is adjustably fastened.

7. An electrical circuit interrupter comprising a pair of relatively movable contacts, a contact support on which one contact is fixed, a spring fixed at one end to said support and bearing the other contact fixed thereon, a rotatable cam member at one side of said support, a rubbing block bearing on said cam member and engageable with said spring to lift the spring to relatively move the contacts, a spring fixed to said support and bearing said rubbing block, a mounting block, a means for securing said support in an adjustable manner fast to said mounting block for varying the amount of opening of the contacts, and means for rotating said mounting block to vary the time of the breaking of the contacts.

8. An electrical timer of the class described, comprising, in combination, a pair of separable contacts, a rigid contact support on which said contacts are mounted, a cantilever leaf spring rigidly fixed at one end to said support and bearing one of said contacts fixed permanently thereon, a rotatable cam, a rubbing block between the cam and the free end of said spring, a second cantilever leaf spring rigidly attached at one end to said support and carrying said rubbing block at its free end, said second leaf spring acting to maintain said rubbing block on said cam, a mounting block rotatably mounted about the cam axis, and means for adjusting and rigidly attaching said support for rectilinear movement on said mounting block so the said contacts may be bodily moved together with-

out disturbing them in relation to each other.

9. An electrical timer of the class described, comprising, in combination, a pair of electrical contacts, a rigid contact support for said contacts, a cantilever leaf spring rigidly fixed at one end to said support and bearing one of said contacts fixed permanently thereon, a rotatable cam, a rubbing block between the cam and the free end of said spring, a second cantilever leaf spring rigidly attached at one end to said support and carrying said rubbing block at its free end, said second leaf spring acting to maintain said rubbing block on said cam, a mounting block, and means for adjusting and rigidly attaching said support for movement on said mounting block so the said contacts may be bodily moved together without disturbing them in relation to each other.

10. In an electrical timer of the class described, in combination, a pair of electrical contacts, a rigid contact support, a cantilever leaf spring rigidly fixed at one end to said support and bearing one of said contacts fixed permanently thereon at a point coinciding substantially with the center of percussion of the spring, a rotatable cam, a rubbing block between the cam and the free end of said spring, a second cantilever leaf spring rigidly attached at one end to said support and carrying said rubbing block at its free end, said second leaf spring acting to maintain said rubbing block on said cam at all times, said rubbing block being spaced from said first leaf spring when in a position closest to the cam axis, a mounting block rotatably mounted about the cam axis, and means for adjustably and rigidly attaching said support for rectilinear movement on said mounting block so that said contacts may be bodily moved without disturbing them in relation to each other.

11. An electrical circuit interrupter of the class described, comprising, in combination, a pair of make and break contacts, a cam for effecting make and break action of said contacts, a mounting block on which said contacts are mounted, a reference line on the side of said cam and reference marks on said mounting block adapted to cooperate with said reference line to indicate the opening and closing points of said contacts for a proper setting thereof.

12. An electrical circuit interrupter comprising a pair of make and break contacts, a contact support on which said contacts are mounted in alignment with each other, a rotating cam for effecting make and break action of said contacts, means for adjusting said support to bodily move said contacts equally and simultaneously without disturbing their relation one to the other, a mounting block on which said support is adjustably mounted, a reference line on the side of said cam and reference marks on said mounting block adapted to cooperate with said reference line to indicate the opening and closing points of said contacts for a proper setting thereof.

13. In an electrical circuit interrupter as set forth in claim 12, a reference line on the side of said cam and reference marks on said mounting block adapted to indicate the points at which the contacts are just opening and just closing with the contacts properly set, when aligned with said reference line.

14. An electrical circuit interrupter, comprising a pair of contact supports, each supporting a pair of relatively movable make and break contacts, in permanent alignment with each other, a cam for effecting make and break action of the contacts, means for independently adjusting and fixing said supports to bodily move the contacts of a pair equally and simultaneously without disturbing their relation one to the other, to vary the amount of separation of the contacts of the pair.

15. An electrical circuit interrupter, comprising a pair of contact supports, each supporting a pair of relatively movable make and break contacts in permanent alignment with each other, a cam for effecting make and break action of the contacts, a mounting block, means for independently and rectilinearly adjusting and fixing said supports on said block so that the contacts of a pair may be bodily moved equally and simultaneously without disturbing their relation one to the other, to vary the amount of separation of the contacts of the pair, and means for rotating said mounting block to vary the time of opening of the contacts.

16. An electrical circuit interrupter, comprising a pair of make and break contacts having a permanently fixed facial relation when contacting, a rotatable cam for causing make and break action of said contacts rectilinearly relative to said rotatable cam, and means for adjusting said contacts without disturbing their facial relation to vary the extent of separation or dwell of said contacts without changing the timing relation of said electrical circuit interrupter.

17. An electrical circuit interrupter, comprising a pair of contact supports, a pair of make and break contacts having a permanently fixed facial relation when contacting mounted on each support, a cam for effecting make and break action of said contacts, a rubbing block for each support engaging said cam and operated thereby to make and break the contacts, means for adjusting a pair of contacts without disturbing their permanently fixed facial relation, to vary the extent of separation of the contacts without changing the timing relation of said electrical circuit interrupter, means for rotating said supports about the cam axis, and means for adjusting said rubbing blocks independently in rela-

tion to said cam to vary the time the contacts are opened in relation to the angular position of the cam.

18. An electrical circuit interrupter, comprising a pair of make and break contacts, a contact support to which one contact is permanently attached, a leaf spring fixed at one end to said support and bearing the other contact at its free end in permanent alignment with said first contact, a rotatable cam member, a rubbing block bearing on said cam member and engaging said spring to lift the spring and relatively move the contacts, a leaf spring adjustably fixed to said support and bearing said rubbing block permanently thereon at its free end and operating to maintain said rubbing block in engagement with the cam, means for adjustably attaching said second leaf spring rigidly to said support to variably locate the rubbing block in relation to the cam member, and a mounting block to which said support is adjustably fastened in fixed position.

19. A unitary assembly adapted for electrical circuit breaker mechanism having means for effecting a periodic breaking of said circuit, comprising a movable contact having a permanently fixed facial relation when contacting with said movable contact, a fixed contact, said assembly being adjustable as a unit rectilinearly relative to said means to simultaneously move said contacts without disturbing their facial relation one to another and to vary the extent of separation or dwell of said contacts.

20. A unitary assembly adapted for electrical circuit breaker mechanism having means for effecting a periodic breaking of said circuit, comprising a movable contact having a permanently fixed facial relation with said movable contact, a fixed contact and a cam actuated member for lifting said movable contact, said assembly being adjustable as a unit rectilinearly relative to said means to simultaneously move said contacts without disturbing their facial relation one to another and to vary the extent of separation or dwell of said contacts.

21. A unitary assembly adapted for electrical circuit breaker mechanism having means for effecting a periodic breaking of said circuit, comprising a support, a pair of make and break contacts having a permanently fixed facial relation one to another when contacting, a spring member fixed to said support and carrying one of said contacts, a rigid member fixed to said support and carrying the other of said contacts, said assembly being adjustable as a unit rectilinearly relative to said means to simultaneously move said contacts without disturbing their facial relation one to another to vary the extent of separation or dwell of said contacts.

22. A unitary assembly adapted for electrical circuit breaker mechanism having means for effecting a periodic breaking of said circuit comprising a support, a pair of make and break contacts, a spring member fixed to said support and carrying one of said contacts, a rigid member fixed to said support and carrying the other of said contacts, a lifting member, and a further spring member fixed to said support and carrying said lifting member, said contacts being disposed intermediate of the point of lift and the fixed end of said first mentioned spring member.

23. In a circuit breaker a pair of contacts, a support, a spring member fixed at one end to said support and carrying one of said contacts, a rigid support for the other of said contacts, a lifting member and a further spring member for carrying said lifting member, said contacts being disposed between the point of lift and the fixed end of said first mentioned spring member.

24. A unitary assembly adapted for electrical circuit breaker mechanism having means for effecting a periodic breaking of said circuit comprising a pair of make and break contacts, a rubbing block, a contact support on which one of said contacts is mounted, a spring fixed to said support and having the other contact in fixed facial relation with said first contact and a spring arm fixed to said support and bearing said rubbing block, said assembly being adjustable as a unit to vary the extent of separation or dwell of said contacts without disturbing their facial relation.

25. An electric circuit interrupter comprising a pair of make and break contacts, rotatable means for effecting make and break action of said contacts, a mounting block on which said contacts are mounted, a reference line on said rotatable means, and a reference mark on said mounting block adapted to cooperate with said reference line to indicate the opening point of said contacts for the proper setting thereof.

In testimony whereof we affix our signatures.

FRED GLEN SHOEMAKER.
JOHN J. ROSE.

CERTIFICATE OF CORRECTION.

Patent No. 1,866,492. July 5, 1932.

FRED GLEN SHOEMAKER ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, lines 108 and 109, claim 16, strike out the words "rectilinearly relative to said rotatable cam" and insert the same after "contacts" in line 110; page 6, lines 29 and 30, claim 19, strike out the comma and words ", a fixed contact" and insert the same to follow "contact" in line 27; and line 41, claim 20, strike out the comma and words ", a fixed contact" and insert the same to follow "contact" in line 39; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of January A. D. 1933.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.